ENVIRONEWS

INTERNATIONAL SOCIETY OF ENVIRONMENTAL BOTANISTS

Newsletter

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IN THIS ISSUE

PRESIDENT'S MESSAGE

Environews was launched on 1st January 1995 and, with this issue, it completes thirteen years of its publication. Over these years it has grown, in circulation and scientific content. The Readers' mail received by us from different parts of the world (some of which is published in ***Environews)***, bears enough testimony to the global reach and popularity of the newsletter. Though essentially a popular science magazine, purely scientific articles/papers on topics of general interest are also included in every issue. It is heartening to notice that the articles published in ***Environews*** are sometimes being cited in international scientific journals.

International Society of Environmental Botanists (ISEB), which publishes ***Environews***, has steadily increased its membership and earned an enviable reputation for its significant contributions in the fields of environment and plant sciences. The membership of ISEB is spread all over India as well as in countries like, U.K., U.S.A., Canada, Sri Lanka, Bangladesh. The growth and popularity of ISEB, owes much to the ***Environews***.

ISEB website (http://isebindia.com), was set up some three years back. Its wide popularity can be gauged from the fact that, as of today, some 8700 individuals from different parts of the world have visited this site and downloaded valuable information from it.

I hope and pray that ISEB and ***Environews*** will grow even faster in the coming years. The relationship between NBRI and ISEB is an impressive example of symbiosis. I would like this bond to become stronger, mutually beneficial and more fruitful in the coming years.

Rakesh Tuli
President ISEB &
Director NBRI

IMPORTANT

- *While readers of **Environews,** members of ISEB, conference organizers and publishers of books and periodicals are welcome to submit letters, news and views, news flash for publication in **Environews,** prior consent is necessary for submission of scientific articles/papers. Unsolicited articles will not be considered for publication due to paucity of space.*
- *Members of ISEB are advised to immediately notify any change in their mailing address and/or e-mail IDs to Secretary ISEB.*

- Informative news, views and popular articles/write-ups on current environmental researches/issues are invited for publication in ENVIRONEWS.
- Environews is published quarterly on the first of January/April/July/October; and is supplied free to all members of ISEB.
- Environews is also supplied in exchange for scientific literature published by reputed organisations.
- All correspondence should be addressed to : **The Secretary, International Society of Environmental Botanists,** National Botanical Research Institute, Lucknow - 226 001 (India).
- **E-mail : isebnbrilko@satyam.net.in • Website : http://isebindia.com**

LETTERS

I am grateful to you for your good wishes on my nomination to the Rajya Sabha. I am also grateful to you for mentioning this in your website. I wish ISEB continued success in promoting environmentally sustainable development.

Dr. M.S. Swaminathan
President, Pugwash Conferences on Science and World Affairs
Chairman, M S Swaminathan Research Foundation Third Cross Street, Taramani Institutional Area, Chennai - 600 113 (India)
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Greetings from Brunei. I reached here safely and joined my duties. The atmosphere is very congenial for working, no pressure, no tension, no problems. Very peaceful place and peace loving people.

Here some other international groups are working, one American group is working on 'Ants', a British group on 'Ferns' and German group on 'Frog biology'. All these groups are working with out any fellowship from Brunei. They have got partial grants from their govts. Here working atmosphere is excellent. I really feel like showing all these places to all my friends, near ones and dear ones. The city, shopping centres, roads, traffic etc. remind me of USA. Actually Sultan is very generous and gives importance to the welfare of his subjects, their education, health, wealth etc. So, people are quite content. A small country with a small population of 350,000 only.

Dr. M.R. Suseela
Scientist NBRI (camp: Brunei)
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I have superannuated from the position of Director, Indian Grassland & Fodder Research Institute, Jhansi and have settled at Lucknow. I shall like to interact from here through email, if I can be of any help to your organization.

P.S. Pathak
K-1/1450, Aashiyana colony, Kanpur Road Scheme
Lucknow 226012**, India**
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I still have a dream to visit your institutions (ISEB and NBRI) for a couple days to learn more on on-going activities and establish a close cooperation between botanists. I hope you will find a time to visit our university also.

Please convey my congratulations to Prof. Rakesh Tutli, President ISEB for winning prestigious award "J.C. Bose Fellowship".

Dr. Muhtor Nasyrov
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Since my arrival at Kew in October 2006, we have been taking a fresh and methodical look at the ways in which we can use Kew's remarkable expertise and global resources to do even more to improve the prospects of people around the world. In building our new mission statement, I was personally delighted to see how the new direction emerged from the enthusiasm of staff, volunteers, supporters and stakeholders.

Of course, large-scale global impact will only come through partnership, particularly where it has strong government backing as it has in the UK. We also know that there is a huge potential for collaboration around the seven key priorities set out by us. These are:

Creating global access to essential information; identifying species and regions most at risk; helping implement global conservation programmes; extending the Millennium Seed Bank's global partnership; establishing a global network for restoration ecology; identifying and growing locally appropriate species in a changing climate; using botanic gardens as shop-front opportunities to inform and inspire.
If you believe that there could be a new opportunity for us to work together then I really would like to hear from you.

Prof. Steve Hopper FLS
Director
Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB, **U.K.**
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WELCOME NEW LIFE MEMBERS OF ISEB

Dr. V.P. Kapoor, Ex-Deputy Director & Head, Phytochemisty Department, National Botanical Research Institute, Lucknow. He has recently completed his tenure as Emeritus Scientist-CSIR at the Institute. He is a prominent plant chemist having expertise in the field of phyto-chemicals with special reference to vegetable gums, natural dyes, herbal products and herbal cosmetics. He is the inventor of the safe and eco-friendly Herbal Gulal and Herbal Sindoor, which have been prepared for the first time using natural dyes only. He has contributed significant R&D work on the revival of natural dyes through tackling their technical drawbacks and techno-economic constraints. The Association of Carbohydrate Chemists and Technologists (India) has awarded him "Lifetime Achievement Award" for his novel advanced basic and R&D contributions in carbohydrate research. He has published over 70 research papers in reputed national and international journals and supervised many students for their Ph.D. degree. He has visited France in 1988 & 1992-93 and U.K. in 1997.

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Dr. Daizy R. Batish is a Reader at the Department of Botany, Panjab University, Chandigarh, India. Her research interests include ecophysiology of the plant interactions, tree-crop interactions under agroforestry systems, biology and ecology of invasive weeds, ecological weed management and allelopathy. She teaches Ecology, Environmental Botany and Forestry, and Pteridophytes to the undergraduate and postgraduate students. She has to her credit over 65 research papers in refereed

journals, 5 books, and 35 research articles. She has guided 10 Ph.D. and 5 M.Phil. students. She is a recipient of Rajib Goyal Young Scientist Award in Environmental Sciences and University Grants Commission (India) Research Award.

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Dr. S.K. Barik is Professor of Ecology in the Department of Botany at North-Eastern Hill University (NEHU), Shillong. Professor Barik obtained Ph.D. degree in Botany in 1993 from NEHU, Shillong under the supervision of Prof. R.S. Tripathi, FNA an eminent ecologist of India. After doing his Ph.D., he joined the State Forest Research Institute, Government of Arunachal Pradesh, Itanagar as Senior Scientist. During his tenure there, he successfully developed and tested two integrated land-use models for rehabilitating the degraded fallow lands created by shifting cultivation. In the year 1997 he came back to Shillong to take up a faculty position at NEHU, where he rose to the position of Professor of Botany in 2006. Presently, Dr. Barik is one of the youngest Professors of Botany in India.

He has been actively involved in research in the fields of ecology, biodiversity conservation and natural resources management in northeast India. He has done pioneering research on gap phase regeneration of forest trees, which has been highly cited world-wide. His current research interests are: (i) population ecology of threatened and endemic plants, (ii) forest fragmentation and its impact on plant populations, (iii) regeneration ecology of trees, medicinal plants and bamboos, (iv) studies on carbon sequestration, and (v) analysis of forest ecosystem including sacred groves. He has successfully completed several research projects in the fields of ecology, community forestry, biodiversity, ethnobotany, environmental impact assessment and natural resource management, which were funded by international agencies such as IFAD, ICIMOD, UNESCO, CIFOR, Ford Foundation, MacArthur Foundation, Community Forestry International, and different national funding agencies. He has published 35 research papers in reputed peer-reviewed scientific journals, and has authored 4 books and 35 technical reports/booklets. He has also edited 3 books on various aspects relating to plant ecology, environment and natural resource management. He has co-authored the North-East Ecoregion Biodiversity Strategy and Action Plan, Arunachal Pradesh State Forestry Action Plan, and Meghalaya State of Environment Report, 2005.

Prof. Barik is also the Joint Coordinator of the Regional Centre, National Afforestation and Ecodevelopment Board, Ministry of Environment and Forests, Government of India at NEHU, Shillong. He is actively involved with the activities of the Regional Centre for the past 18 years. In recognition of his outstanding contributions in the fields of ecology and development, he was selected as a LEAD Fellow (Leadership in Environment and Development programme of LEAD International, sponsored by Rockefeller Foundation) in the year 2000. He is serving as the Member/ Chairman of several important committees constituted by Government of India.

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NEWS FLASH

DR. SWAMINATHAN NOMINATED FOR RAJYA SABHA

Well known Indian Scientist and Chairman of M.S. Swaminathan Foundation. Dr. M.S. Swaminathan, F.R.S. has been nominated as a Member of Rajya Sabha (Upper House of Indian Parliament) by the President of India. He was the Director General of Indian Council of Agricultural Research and Chairman of Farmers' Development Commission. Presently, Dr. Swaminathan is President of Pugwash Conferences on Science and World Affairs.

International Society of Environmental Botanists is privileged to have a long and fruitful association with Dr. Swaminathan. He had especially come down to Lucknow on ISEB's invitation to inaugurate the Second International Conference on Plants & Environmental Pollution (ICPEP-2) in February 2002.

PROF. BANDANA BOSE WINS SHIKSHA RATTAN AWARD

Prof. Bandana Bose, former Head, Department of Plant Physiology, Institute of Agricultural Sciences, Banaras Hindu University and a Life Member of International Society of Environmental Botanists has been awarded the '**Shiksha Rattan Puraskar**' by the '**India International Friendship Society**', New Delhi. The award was presented to Dr. Bose for her meritorious services, outstanding performance and remarkable role in education. Previously, Dr. (Mrs.) Bose has been awarded with Dr. R.D. Asana Young Scientist Medal for her excellent work in Plant Physiology by the Indian society for Plant Physiology. Her work is related to various Physico-Chemical studies specially Nitrogen Metabolism in crops, growing in normal as well as in various abiotic stresses. Presently Dr. Bose is working as a Senior Professor of the Department of Plant Physiology, Institute of Agricultural Sciences, B.H.U., Varanasi.

Dr. Rakesh Tuli, Director, National Botanical Research Institute (NBRI) & President ISEB, took over as Director (additional charge), of Central Drug Research Institute (CDRI), Lucknow recently. Dr. Tuli is a distinguished scientist of international fame, with specialization in plant molecular biology and biotechnology. His contributions in the field of molecular genetics of crop and medicinal plants have been highly acclaimed, particularly his efforts to produce plant based vaccines, Bt-cotton and gene expression studies.

Prof. R.S. Tripathi, Life Member and Advisor, ISEB, has been nominated as a Member of the Expert Group on "Conservation and Sustainable

Utilization of Natural Resources" recently constituted by the Ministry of Environment & Forests, Govt. of India. The Expert Group is mandated to scrutinize research proposals falling under the relevant thrust areas, identify experts for peer review, recommend research proposals for financial support, and to review progress and evaluate the final technical reports of the research projects funded by the Ministry. The tenure of the Expert Group would be for three years i.e., until 2010.

Dr. U.N. Rai, Scientist and a Life member of ISEB acted as a Chief Guest in one-day Science Communication Training Programme organized by District Science Club, Rae Bareli and UP CST, Lucknow at Dayanand P.G. College, Bachhrawan on 17 August 2007 and delivered presidential address on the topic "Environmental pollution, human health and its remedial measure using plants".
Mr. M.K. Shukla, spoke on this occasion on various aspects of scientific and technological development in the society as Chief Speaker.

ISEB AWARENESS PROGRAMME

International Society of Environmental Botanists, Lucknow, in collaboration with Eco-auditing and Eco-education Sections of the National Botanical Research Institute organized an environmental awareness and educational programme on 23rd August 2007 at Ram Chaura village, Banthra, some 25 km from Lucknow off Kanpur Road. A team of scientists headed by Ms. Kanti Srivastava, Convener, ISEB Environmental Awareness Programme and comprising Ms. Babita Mishra, Dr. Tabassum Shaikh, Ms. Anjana Rai, Ms. Beena Dixit and Mr.Vijay Kumar Yadav delivered popular lectures on environmental protection, health, hygiene, plant wealth utilization. They also gave practical demonstrations and training to the assembled students and the housewives of the village.

Soil Carbon in Agroecosystems: Issues and Challenges

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Soil organic matter - the accumulated, decaying debris of biota living on or in the soil is comprised of highly heterogeneous components, cellular structures to amorphous compounds, including recent root exudate to extremely persistent humified material. Being the main nutrient source for plant growth, it contributes significantly to the maintenance of soil quality. Forming the major carbon reservoir of the biosphere-atmosphere system, soil organic matter is a key determinant of carbon and nutrient cycling in the biosphere. Globally, in terrestrial ecosystems maximum amount of C is stored in soil organic matter. Carbon sequestration occurs mainly through biological transfer of atmospheric CO_2 into long-lived and recalcitrant pool in the soil. Processes of soil organic C sequestration include humification, aggregation and deep incorporation of C in the subsoil. In this article we briefly discuss the current understanding and research avenues related to organic matter dynamics and C sequestration in soils with special reference to agroecosystems in tropics.

The increasing anthropogenic pressure on natural terrestrial ecosystems (notably forests) through past few centuries has caused their extensive degradation and even conversion into agroecosystems. Consequently, C stored in the soil has declined drastically in cultivated soils. For instance, in the dry tropical regions of our country agricultural soils generally show less than one-half C content relative to local forest soils. Agricultural practices typically deplete soil C because harvesting removes major fraction of photosynthetically fixed C, and therefore, least amount of plant litter is returned to the soil. Soil working in agroecosystems disrupts aggregate structure (making organic matter more accessible to biological decay), mixes fresh litter into the soil, and increases erosion of C-rich surface layer. It is believed that agroecosystems offer immense opportunities for attaining substantial increase in soil C sequestration, serving as large C sink in global climate change context.

While the basic processes of C sequestration in soils of tropical and temperate regions are similar, the sequestration rates are generally lower in the tropics due to the prevalence of high temperatures and microbial activity throughout the year. Occurrence of long growing season in tropics, which cover approximately 40% of the world land area, raises hopes of achieving huge soil C sequestration in the region by experimenting with land use alterations and applying ecologically sound management practices. These measures will include restoration of degraded soils and ecosystems, bio-fuel offset and recommended practices on croplands and grazing lands.

Plants supply organic matter to soil through biomass production, senescence and exudation/leaching. Soil fauna and microorganisms transform and breakdown added organic material through decomposition. Most organic compounds are processed by heterotrophic microorganisms in soil that use organic C as nutrient and energy source. Accurate quantification of inputs of C into and outputs of C from soils, often difficult to measure, is essential to assess the storage and changes of soil organic matter with time. Such measurements will help unravel the mechanisms that control C storage (to optimize the return of C to the soil) and formulate robust models of soil C dynamics and turnover. Better understanding of C dynamics, which

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drives fluxes of other nutrients, can be useful to search ways to improve the soil environment.

Models of soil organic matter dynamics reflect the complexity of interactions existing within the soil environment and help evaluate the effects of environmental and management changes at local, regional and global scales on rates of turnover. Most models conceptualize that C resides in soils in several discrete pools showing varying rates of turnover and loss. It is commonly assumed that soil organic matter can be fractionated into a smaller labile pool and one or more larger recalcitrant pools, each decaying according to first order kinetics. Using such approaches, several soil organic matter models have been developed, such as Century (formulated by WJ Parton et al.), Roth-C (K Coleman et al.), CANDY (U Franko et al.) and DNDC (C Li et al.). These largely empirical models have generally provided good predictions of C loss in diverse environments, usually over longer time periods. Despite limitations of less reliable short-term predictions and uncertainty of pool homogeneity and uniqueness, these models are helpful in organizing soil C information. When soil organic matter models are integrated within whole ecosystem simulations, better evaluation of ecosystem responses to environmental change can be done. Thus, it is possible to identify the strategies optimizing C sequestration through specific management of soil and vegetation.

Natural C inputs to soil in agroecosystems occurs mainly by incorporation of aboveground crop residues and by functions associated with root systems. However, the knowledge base quantifying the amount and timing of belowground C inputs is poor and the relative importance of root mortality and exudation in contributing to soil C inputs are also debated. While some studies using minirhizotrons and pulse labelling techniques indicate root senescence and mortality to be main contributors to C addition to soil, other pulse labelling studies suggest exudation and pre-root-mortality C loss to be more important. While live roots exude C compounds and release respiratory CO_2 at variable rates through the growing season, root mortality builds up necromass which undergoes decomposition, releasing CO_2 through microbial respiration (the major component of soil respiration) and sequestering C in long-lived organic matter. Our studies have shown that release of C and other nutrients from decomposing root necromass from one crop continues through the growing period of the succeeding crop. Crop/annual cycle based research on root-soil interactions and processes is required with a view to selecting possible measures for manipulating C inputs to the soil through the crop root system.

Soil C loss occurs through biological (soil respiration) as well as physical (leaching and soil erosion) processes. On a global basis soil respiration is believed to be the main C loss pathway. The microbial biomass that plays a major role in transforming inputs of organic matter also controls C loss. Our field measurements of soil respiration in dryland agroecosystems show wide variations due to seasons as well as types of soil amendments. Thus, apart from the controlling effect of environmental variables (principally temperature and soil moisture), the rates of soil respiration are strongly affected by various management practices. Available data suggests that soil respiration is significantly increased due to the accelerated oxidation of labile C caused by cropping operations. It is important to understand the processes controlling soil respiration rates in order to devise strategies for effective C sequestration.

Appropriate land management can contribute significantly to soil C sequestration by manipulating agroecosystems to generate greater biological inputs of C than losses. Farming practices since ancient days have improvised procedures that enhance soil fertility by increasing the input of plant materials (e.g. shifting cultivation where cultivation is alternated with forest regeneration and growth). Precise estimates of C input and loss from soil provide the capability to quantify in short terms changes in soil organic C storage resulting from a specific land use change; such critical methodology may become increasingly important in relative assessment of the different land use change options with respect to C sequestration. Quantifying the effects of management practices and their combinations on C sequestration is vital for improving the potential of farming systems to sequester C.

In agroecosystems both crop yield and soil C sequestration are generally increased by using organic farming, tillage reduction, residue management, choice of crops, efficient irrigation and pesticide use. Our work in rice based dryland agroecosystem indicates that a judicious mix of high and low quality organic soil amendments tends to increase C sequestration as well as crop productivity compared to these amendments applied alone. Even weed biomass may substantially contribute to C sequestration.

Recent estimates made by R. Lal of Ohio State University, USA, indicate wide variations in C sequestration potential of different land use changes and recommended agricultural practices. For instance, land use change restoring degraded soils or conversion of marginal soils to restorative land use may sequester 50-300 kg C $ha^{-1}yr^{-1}$. Sequestration under different agricultural practices may approximate: Zero/reduced tillage 100-1000, use of cover crops 50-250, manuring 50-150, mixed farming 50-200, and agroforestry 100-200 kg C $ha^{-1}yr^{-1}$.

It must be emphasized that soil C studies might not strive only to maximize C pools; instead the approach should aim to establish a balance between amounts held in reserve (pool) and amounts used for microbial activity (flux). A balance between soil C pool and flux, and consequently soil C turnover, regulates ecosystem services related to nutrient supply. Maximum benefit can be derived from accumulated organic matter when it undergoes decomposition. But the benefits of

decomposition (e.g. mineralization of nutrients and humification) can be maximized when the decomposition-products are released at the time of active growth and greatest nutrient demand by plants (synchronization of nutrient demand and availability). Better management of the annual pool-flux balance can be done by appropriate selection of crops, tillage, addition of residues and manures, irrigation, etc. Such management efforts require wide variety of research inputs, both long-term and short-term goal oriented, in different cropping systems with a view to manipulating agroecosystem processes for sustained C balance in agricultural landscape.

GROUND-LEVEL OZONE IN THE 21ST CENTURY: SUBMISSION OF EVIDENCE FROM THE AIR POLLUTION CROP EFFECT NETWORK (APCEN)

Lisa Emberson
Stockholm Environment Institute, York, ***U.K.***

1. Brief introduction to APCEN

The APCEN Network facilitates information exchange between air pollution effect scientists and air pollution stakeholders with the specific aim of developing methods to reduce impacts on crop productivity and quality in developing country regions. APCEN comprises over 60 members from countries predominantly in Asia, Africa, Europe and North America. The methods employed by the network include observation, experimental and modeling techniques, with a focus on standardization of assessment and application of these various tools within and between different global regions. The network is working towards developing methods to make socio-economic impact assessments that can be used to identify appropriate policy interventions at a range of geographical scales.

2. Evidence of Impacts of ozone by region

Over recent years APCEN has been involved in activities to try to collate and synthesise information describing current day impacts of air pollution, with a focus on surface ozone, in developing country regions. These studies have been synthesised in a number of publications.

Both current day evidence of impacts as well as studies that provide some insight into potential future impacts of this pollutant on crop productivity and crop quality are presented here. Where possible this information is provided in national context in terms of food security and pollution control. We also detail what we believe to be some of the urgent research priorities for the future to provide more comprehensive assessments of damage.

2.1 Current day impacts
Asia

In Asia ground-level O_3 concentrations are alarmingly high in some large metropolitan areas. Severe O_3 episodes are now observed in many countries such as China, Japan, Korea, Taiwan and Thailand. Ground level O_3 concentrations of these countries typically show peak concentrations in the range of 90 200 ppb in the afternoon during ozone episodes. In Japan, frequent observations of visible foliar injury in many crop plants during the summer months (June to August) coincide with conditions when O_3 concentrations frequently exceed 100 ppb) with some of the most frequently affected crops being rice, maize, peanut, tomato and aroid.

In northern Taiwan, observations of O_3-induced visible injury on plant species such as leafy sweet potato and spinach have been made frequently since 1992. To help assess the geographical extent and frequency of such O_3 symptoms researchers in Taiwan have used an active bio-monitoring approach as a cost-effective means of evaluating the pollution situation. This approach has used 2 native (double-fortune tomato and black nightshade) and 2 foreign (Bel-W3 tobacco and morning glory) indicator plants for O_3 and has been successful in identifying annual pollution episodes of four urban areas of Taiwan where the bio-monitoring experiments were established.

Potentially damaging high O_3 concentrations have also been found in other parts of south east Asia with frequent exceedences of national ambient air quality. In Southeast Asia the levels in big metropolitan regions such as Bangkok, Jakarta, Manila, Ho Chi Minh City are rising which may already cause substantial impacts on health and crop production but no comprehensive assessment has yet been performed. Monitoring data are limited, and if available, are mainly for the city centres where ozone would not be maximum. There is almost no data on ozone in city plume in the suburb areas where crops grow.

In south Asia, particularly India and Pakistan, evidences of high concentrations of O_3 have been reported. For example, in India hourly maximum O_3 concentrations of between 10 and 273 ppb have been recorded in Delhi. The limited monitoring that does exist in the region suggests that in general, the northern and western parts of the country experience higher levels of air pollutants compared to south and eastern parts.

In Pakistan, levels of O_3 pollution found in the peri-urban areas outside the city centres reach 72 ppb characterized as 6 hr weekly means. Outside Lahore, controlled experimental investigations using OTCs have investigated the

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impacts of ambient concentrations of O_3 and NOx on the growth of local cultivars of wheat, rice, chickpea, mungbean and soybean crops in comparison with those grown in pollution free-air. The damage caused by the exposure of plants to ambient air pollution included reduced numbers of tillers, shoots and leaves; accelerated leaf senescence and yield reductions of between 23 and 47% (Wahid, Pers Comm.). In addition, studies using "EDU" (N-[2-{2-oxo-1-imidazolidinyl}ethyl]-n2phenylurea) as a chemical protectant to O_3 have shown that seasonal mean O_3 concentrations of 75 ppb for 6 hr per day are sufficient to cause yield reductions of up to 64% to soybean in remote rural areas 30 km from Lahore.

Concern that impacts may be occurring in the Middle East is also emerging. For example, in Iran and in particular Tehran, such concern has resulted in the establishment of more than 15 air quality monitoring stations for a range of pollutants including O_3. The proximity of agricultural areas to Tehran and other large urban centres across the country, raises concerns over the impact that air pollutants such as O_3 may be having on crop production.

Africa

The increases in air pollution that have occurred around the urban industrial centres of Cairo and Alexandria in Egypt are particularly problematical since these are in the same location as the primary agrarian region, which is limited to the Nile river basin as the primary source of irrigation water. Studies of the effects of air pollution on vegetation have been carried out in the last 20 years in the greater Cairo area and around the main roads within the Nile delta region.

Hourly mean O_3 concentrations were also recorded greater than 100 ppb. Visible injuries included necrosis, red spots and chlorosis with 60 % and 54% of clover and Egyptian Mallow leaves injured respectively.

The impact of O_3 has been assessed on the growth and yield of local varieties of radish (*Raphanus sativus* L. cv. Balady) and turnip (*Brassica rapa* L. cv. Sultani) at sub-urban and rural sites in Alexandria using EDU to protect control plants from O_3 effects. O_3 impacts included the formation of chlorotic spots on the upper leaf surface and reductions in plant biomass. These effects were recorded for radish at both sites and for turnip only at the rural site. The study proved that levels of ambient O_3 in Egypt are high enough to have significant impacts on the growth and yield of local varieties of vegetable crops, even at a time of year when O_3 levels are relatively low.

Latin America

We are not aware of any studies investigating the damage of surface ozone to crops in Latin America, however, there is evidence of damage to forest trees. In Mexico, the most serious air pollution occurs in the vicinity of Mexico City associated with high O_3. O_3 damage to several species of *Pinus* was observed in a southern forested area of Mexico City. Injury included chlorotic mottling and premature senescence. O_3 damage was most prevalent at the end of spring and the beginning of the summer season. *P. hartwegii* has been identified as one of the most sensitive species to O_3 exposures.

The sudden decline in sacred fir trees (*Abies religiosa*) observed in the "Desierto de los Diones" national park located to the south west of the Mexico valley, is considered to be caused by O_3 pollution due to the occurrence of O_3 visible injury symptoms.

Australasia

Most studies of the effects of ozone on Australian native species have been short-term studies using high concentrations to assess acute visible injury. In a longer-term study on eight *Eucalyptus* species there were differences in the responses of the different species. Some species showed no visible injury or growth changes, but others showed up to 90% leaf injury and 30% growth reductions. The findings were generally consistent with those found for North American woody perennials and northern European herbaceous species.

The evidence from Australia would suggest that those planning *Eucalyptus* plantations in regions of the world with high or increasing levels of tropospheric ozone, such as rapidly industrializing nations of Asia and South America, need to consider ozone tolerance when selecting plantation trees.

2.2 Regional risk assessment studies

Based upon dose-response data from US and European studies and a limited amount of Australian data including field pollution gradient studies using ozone-sensitive varieties of plants, current ambient concentrations of ozone in the regions around cities are likely to reduce growth and yield of sensitive crops, and damage some areas of biodiversity importance.

However, regional studies have been conducted in East Asia and China. These suggest that yield losses of staple crops may be currently in the range of 1 to 10% and predict future losses of 4 to 30% in 2020; local yield reductions may be much greater than these regional-scale estimates. Factors that may alter plant response to O_3 include those associated with climate, agricultural management practices, crop phenology, genetically based tolerance or resistance and pollutant exposure patterns. However, there is still an urgent need to establish dose-response relationships for locally grown species and cultivars under local environmental conditions and management practice regimes.

The APCEN network identified some of the most important crops for future studies based on existing information describing ozone injury and damage and the importance of the crop as an agricultural commodity. Here we focus on Asia since this is the region where impacts to agriculture are perhaps most severe outside Europe and North America.

3. Conclusions

- There is substantial evidence of the effects of ozone damage on both crop productivity and forest health across many parts of the globe outside Europe and North America. In particular, Asia would appear to be at particular risk from loss in agricultural productivity at current ozone levels and studies suggest the situation could significantly worsen in the future.
- There is evidence of variability both within and between species and species cultivars. Further studies are urgently required to further understand which species and strains may be resistant to ozone pollution so that appropriate crop substitution can be employed within high-risk elevated ozone regions.
- There is also an urgent need to perform regional risk assessments based on dose-response relationships suitable for local species and varieties. These risk assessments may also benefit from the use of flux-based rather than concentration-based methods since these may provide a better opportunity to disentangle the influence of environmental stresses on crop sensitivity to ozone.
- Additional experimental research should be conducted in the future. In particular, the use of FACE systems should help to provide reliable crop response data free from many experimental artifacts. These, rather expensive, experimental systems should be supported with a range of experimental techniques including enclosed chamber, filtration, transect and bio-monitoring studies. Where possible, these studies should also investigate the influence of climate change stresses on ozone sensitivity.
- There is an urgent need to conduct co-ordinated and standardized ozone monitoring across the globe in peri-urban and rural areas to complement existing monitoring in developing country regions that tends to be performed in urban areas. This will capture the higher ozone concentrations that occur downwind of urban areas and also provide information that can help crop-based risk assessment studies.

Finally, investigation of the potential indirect effects caused by ozone impacts on vegetation should be investigated as a priority, especially where these have direct links with climate change. For example, the effects of ozone reducing transpiration may well alter local and regional climatic systems.

Bryophytes: A useful tool in heavy metal monitoring

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The bryophytes are autotrophic cryptogams and an important component of the flora. They occur throughout the globe in different habitats, particularly on moist and shady places. They grow on soil, rocks, tree trunks, branches, leaves, buildings, old monuments etc. and in wetlands.

Environmental pollution is increasing day by day, posing a very serious problem for the flora and fauna. A large number of pollutants including heavy metals are adversely affecting our environment. Heavy metals are emitted from solid fuel combustion, vehicular emissions and in industrial processes. Bryophytes are widely used as bio-indicators for their unique and very specific responses. Some bryophyte species are extremely sensitive to pollutants and exhibit visible injury symptoms even in the presence of very minute quantities of pollutants. Such species serve as good bio-indicators and act as a "warning giver" regarding the effect on the solubirity of the environment. Some other species of bryophytes possess the capacity to absorb and retain pollutants in concentrations much higher than those absorbed and retained by the higher plants growing in the same habitat. The uptake mechanisms of elements in vascular plants and bryophytes are vastly different. Vascular plants mainly meet their nutritional requirements by absorbing them from the soil through their developed root system and their foliar systems also help in the uptake of gases (e.g. NO_2, NH_3 and SO_2) from the atmosphere, whereas bryophytes obtain their nutrition by absorbing the substances dissolved in air moisture from their general surface.

Metal analysis has become a frequently used and dependable yardstick in the evaluation of the environmental quality of a given site. The method was first used by Rűhling and Tyler (1968) to analyze lead in mosses to monitor roadside pollution in Sweden. Rao et al (1977) analyzed Pb, Cu, Zn, Ni, Cr and Cd of some mosses from herbarium specimens collected during 1905 to 1971 from Mount Royal in Montreal, Canada. He found significant increase in Zn concentration in all the mosses selected for studies. A study on bio-monitoring of heavy metals due to vehicular pollution with the help of Sphagnum has also been done by Saxena (2001). The high accumulation capacity of bryophytes for pollutants has led to their use for heavy metal monitoring.

Bryophytes are known as efficient accumulator of heavy metals because of their following properties:-

1. They lack true root system and depend largely on atmospheric deposition for their requirements of mineral elements.
2. They usually lack continuous cuticle layer and thus their tissues are easily permeable to water and minerals, including the gaseous pollutants in the atmosphere and the metal ions.
3. Their tissues have numerous negatively charged groups and act as

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an efficient cation exchangers. Their cell walls possess high exchange capacity and even their dead tissues have capacity to bind ions.

4. They generally obtain mineral nutrition from wet and dry deposition of particles and soluble salts. However, in certain bryophytes, uptake of metals from substrate occurs, mainly with rising capillary water. Such bryophyte species are less suitable for the monitoring of heavy metals.

Several experiments have been carried out to study the sensitivity of bryophytes to heavy metals. In these experiments bryophytes have been cultivated from gemmalings, spores or as transplants, for a few days to few months. In these experiments major emphasis has been given to the growth rate, however, changes in the chlorophyll contents/protein, carbohydrates, lipids have also been recorded. Lead (c. 0.003mM) inhibits the elongation of *Funaria hygrometrica* protonema while high concentrations of Zn (c. 1mM) caused damage to the cells on leaf margin and midrib of the younger leaves of *Plagiomnium rostratum*.

Transplants of bryophytes have been used in a number of studies in assessing heavy metal deposition rates. Goodman and Roberts reported that *Hypnum cupressiforme* transplanted in industrial area in Wales died after sometime, but it continued to accumulate heavy metals after death. In India, studies on heavy metal monitoring, has also been carried out by transplanting *Marchantia polymorpha* and *Brachythecium populeum* at vehicular polluted sites in Mussoorie. Nath and his co-workers have carried out passive monitoring of heavy metals with the help of nine taxa of bryophytes and have found that *Plagiochama appendiculatum* and *Marchantia paleacea* are good accumulators of heavy metals. Recently, Sharma and Kapila investigated 25 moss samples to monitor the lead pollution in various parts of Chandigarh city. In Japan, bryophytes have been used as a bryometer to assess the air quality. Thus, bryophytes are being used for air quality monitoring in various countries.

Bryophytes known to accumulate and used as evaluators of specific heavy metal pollution are indicated here under.

Bryophytes	Heavy metals	Name(s) of researcher(s)
Philonotis Fontana	Pb	Shimwell & Laurie (1972)
Pohlia nutans	Cu	Dykeman & De Sousa (1966)
Merceya ligulata	Cu, Fe	Persson (1948)
Merceya gedeana	Cu, S	Noguchii (1956)
Bryum psedotrquetrum	Pb, Zn	Shimwell & Laurie (1972)
Dicranella varia	Pb, Zn	Shimwell & Laurie (1972)
Fontinalis antipyrietica	Zn	Cymerman *et al* (2002)
Hypnum cupressiforme	Pb	Ellison *et al* (1976)
Plagiothecium denticulatum	Pb,Cu,Zn	Gupta (1995)
Physcomitrium pyriforme	Pb,Cu,Zn, Mn	Manjul Misra (2006)
Hydrogonium gracilentum	Pb	Sharma & Kapila (2007)

Monitoring of heavy metals through bryophytes is not only cost-effective, but it also provides efficient way to assess the qualitative and quantitative differences in metal concentrations at distinct locations and on local and landscape scales.

INSA-ISEB ENVIRONMENTAL AWARENESS PROGRAMME ON CLIMATE CHANGE AT NBRI

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An awareness programme on climate change was jointly organized by the Indian National Science Academy (INSA) Lucknow Chapter and the International Society of Environmental Botanists (ISEB) at the NBRI auditorium on Thursday, 19 July 2007.

Dr. Nitya Anand, former Director, Central Drug Research Institute, Lucknow was the chief guest.

On this occasion, a debate competition on "Global Climate Change" among the school children was organized with an aim to educate and sensitize the students of the dangers posed by the climate change brought about by human's activities on the planet earth.

Dr. Rakesh Tuli, Convener INSA Lucknow Chapter and President, ISEB, while welcoming the chief guest Dr. Nitya Anand, stressed the need to make concerted efforts towards creating awareness regarding protection of environment and conservation of biodiversity. "The consequences of climate change are far reaching and this is clearly visible in the reduction of crop yields to the tune of 10-20% for an increase of 1°C in temperature. About 1 percent of the nation's GDP is devoted to mitigate the effects of climate

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change", said Dr. Tuli. He further added that with every 1°C rise in temperature, the production of rice and other crops would decrease by 10%.

The Secretary of ISEB, Dr. K.J. Ahmad in his opening remarks appraised the gathering about the ongoing activities of the Society. He emphasized the fact that the degradation of planet earth was the result of over-exploitation of its natural resources by the people of present generation.

In his thought-provoking address, the chief guest, Dr. Nitya Anand said that there is a delicate balance between the biotic and the abiotic components of the environment, which we should not disturb and make a serious effort to live in harmony with the nature. An inquisitive mind, especially towards the working of the ecosystem and its components, among young children, would create greater awareness and help in protecting the environment. He further added that the need to preserve the environment from green house gases is no more a theoretical consideration but the degradation, even in our country, has started taking its toll. Like (1) the Gangotri, Jamnotri and many other glaciers of the Himalayas have been receding by metres every year. This means that these glaciers are shrinking fast and rivers fed by them would stop being perennial; (2) The Sagar island, off the coast of West Bengal, has lost 70 square kilometers of its land mass to the rising sea rendering thousands of people homeless; (3) The rising sea has caused the rivers of the Sundarbans to swell and erode banks, mangrove forests of the Sunderbans and, thereafter, Kolkata would not last much longer; (4) Not unheard of is the melting away of the sacred Amar Nath Shiv Lingam.

Unless we start taking immediate steps it may be too late to act to preserve our environment to secure healthy life for the future generations. Dr. Anand stressed the need for a sense of inter-connectivity between all that exists in the universe whether living or non-living and the need to conserve it.

- importance of biodiversity and to preserve it.
- an understanding of humans not being at the center or the end of the universe but a part of all that exists.
- a sense of "communion" that exists between all forms.
- a basis for humility, compassion and cooperation.
- The students must play a pro-active role in preserving the environment, he concluded.

The CEO, Biotechnology Park, Lucknow, Prof. P.K. Seth shed light on the burning issue of climate change. He said that gene "loaded the gun" while "the environment triggers it". "We have to continuously question ourselves what will happen and how will it happen? Even though Tsunami destroyed many coast lines, there are72 million people who stay on the coast lines in China and 71 million in Bangladesh", Prof. Seth said.

Prof. C.K. Varshney, former Dean, School of Environmental Science, Jawaharlal Nehru University, New Delhi delivered a very interesting and thought-provoking lecture on "Global Climate Change", which was thoroughly enjoyed by one and all. He said that climate change is a complex and rapidly advancing catastrophe with long-term consequences. He added that he was very happy to be able to speak to the school children about climate change, as it is the future generations who will face this real challenge. He emphasized that an increase in green house gases emission is a major fact behind global warming. Industrialization and consumer-driven culture are major factors, and developed countries like the USA, the UK and Germany are major contributors of greenhouse emissions.

He said that one could not in any way disconnect oneself with the environment. The environment is something we are always with and the children today are bound to face the impact of the approaching catastrophe in years to come. Describing the various causes of climate change, he said that human influence had a profound impact on global climate change.

Going into the mechanism of global warming, Prof. Varshney explained that the CO_2 present in the environment absorbs the infra-red radiation emitted from the Sun which causes the temperature of the earth to rise. We should try to follow techniques, which will decrease the production of CO_2 and other such harmful gases. One of the major causes for the rise in earth's temperature is deforestation the cutting down of the majestic trees to expand the contour of the town. He said that every decade the earth's temperature is increasing by 0.5 °C and if it continues to do so, then the earth's temperature is likely to rise by 5 °C in the next 100 years. This will adversely affect the yield of rice. The global response to these challenges needs to move with much determination at all levels global, national and local, by countries and communities as well as corporations and individual citizens across both the developed and developing world.

Prof. Varshney's highly informative lecture was followed by a debate competition wherein the students from various colleges namely, Government Inter College, Montfort Inter College, City Montessori School (CMS), Station Road Branch; City Montessori School Mahanagar Branch, La Martiniere Girls' College, St. Fidelis' College and Isabella Thoburn College participated very enthusiastically.

The first prize was bagged by Ms. Sunandini Chopra of La Martiniere Girls' College, the second prize by Ms. Himika Malik of CMS, Station Road Branch and the commended prize was awarded to Mr. Aishwary Chaturvedi of CMS, Mahanagar Branch. The prizes and certificates were given away by Dr. Nitya Anand. The participating students were also given participation certificates, informative books and other reading material.

Dr. S.K.S. Rathore, Scientist NBRI, compeered the function, while Dr. S.C. Sharma, Vice President ISEB, proposed a vote of thanks.

The function was attended by leading scientists of Lucknow including many distinguished fellows of Indian National Science Academy, eminent citizens and a large number of children from various schools in the city.

The debate competition provided the right kind of stimulus to nurture and sustain the interest of not only the young minds to invest all their efforts in protecting the environment but also to their parents and teachers about the importance of this vulnerable topic in national as well as global scenario. This would provide a kind of platform for future generations of the country. It ended with the hope that teachers and parents shall also work as master trainer.

NEWS AND VIEWS

DEADLY SPIDER UNDER TOILET SEAT

Telamonia dimidiata, twostriped spiders have caused several deaths in many parts of the world. The venom of this reddened flesh color spider is extremely toxic but the poison starts affecting human beings after several days. Death is preceded by fever, chills, vomiting, muscular collapse and paralysis. They live in cold, dark, damp climates and toilet rims provide just the right atmosphere. One person who suffered from this problem had a punctured wound on his right buttock. Before his death he explained that he had taken an international flight during which he had used the toilet in the plane. An immediate inspection of the toilets of all flights that originated from the country, where he had boarded his plane, was carried out. The investigators discovered the two-striped Telamonia spider's nests on 4 different planes.

It is now believed that these spiders can be found anywhere. Before using a toilet, the seat should be lifted to check for spiders. This habit can save lives.

WHY AUTUMNS IS RUNNING THREE WEEKS LATE?

For centuries people have used nature to help predict the coming of Spring and Autumn. New research has shown that changing weather patterns means that many seasonal events are out of sync.

Experts are predicting that autumn could be about three weeks late arriving in Devon island (north of Canada) this year. The Woodland Trust a conservation charity says that the country's flora and fauna have already indicated that the Spring was three weeks early. Now the organization says Autumn could be out of sync as well.

Traditionally, people have predicted the timing of the seasons by the onset of naturally occurring events, such as the arrival and departure of birds, the flowering and ripening plants and fruits; and the start of new life. But according to the new findings, the seasons are being increasingly muddled up and many traditional events are now being thrown out of sequence.

The Woodland Trust believes that this may have serious consequences for many of our favourite animals, insects and trees. Phenologists have found that the arrival of Spring is not constrained to March and the end of Autumn continues well beyond October. Higher than average temperatures from January to April led to almost every characteristic of this year's Spring occurring up to three weeks earlier than in 2001. It has led to concern that the relationships between birds, insects and plants could be disturbed.

Critically, for many species, this could have serious implications for these future survival.

BBC News

OBITUARY

Dr. Bharat Ram passes away

The doyen of Indian Industry, Dr. Bharat Ram died on 10 July 2007 in New Delhi. He was 93. Besides his association with companies, such as SRF Ltd. and other entities of the famous DCM group, he was closely involved with prestigious organizations. He was a great visionary and a philanthropist.

Several years back, Dr. Bharat Ram had paid a visit to ISEB Office at NBRI Campus, where he held lively and scholarly discussions with senior officials of the Society. He greatly appreciated the contributions of ISEB for the cause of environmental protection. Soon thereafter, he joined ISEB as a Patron Member. ISEB deeply mourns the loss of a great well-wisher and a patron.

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13-15 December 2007, New Delhi, India
Contact: Prof. T.R.C. Sinha
General Secretary, National Environmental Science Academy (NESA)
H.O. - 206, Raj Tower 1, Alaknanda Community Centre, New Delhi-110019
E-mail: nesapub@yahoo.co.in; nesa_pub@rediffmail.com

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31 March 2 April 2008; Oxford, U.K.
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Contact: Rachel Swinburn
Conference Manager, Geo-Environment & Landscape Evolution 2008
Wessex Institute of Technology, Ashurst Lodge, Ashurst, Southampton SO40 7AA, U.K.
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